See page 7-2

NORTHEAST ELECTRONICS

A DIVISION OF NORTHERN TELECOM, INC.

INSTRUCTION MANUAL

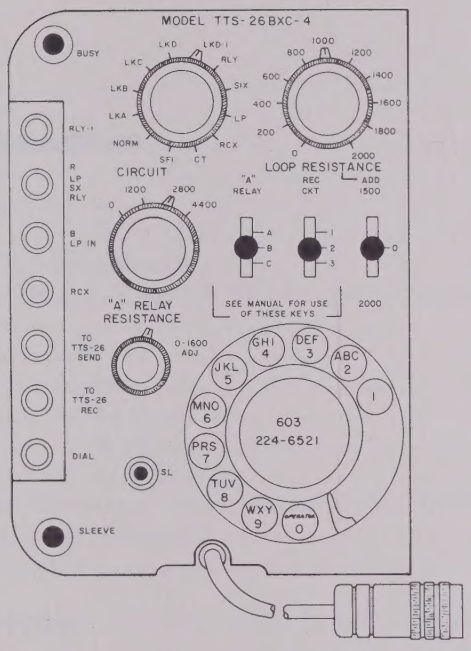
MODEL TTS-26BXC-4

CIRCUIT PANEL ACCESSORY

No. A0026-52-600 ISSUE 2 DATE MAR 1975

PRINTED IN U.S.A.

Airport Rd., Concord, N.H. 03301 • (603) 224-6511 • TELEX 94-3453



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SECTION 1

DESCRIPTION

1.1 INTRODUCTION.

1.2 This manual describes the Northeast Electronics Model TTS 26BXC-4 Circuit Panel Accessory. It is used with the Model TTS 26B Pulse Signaling Test Set to provide leak, balanced loop resistances and test circuits required to test local and toll pulse repeaters. When used with the Model TTS 26BXP Pulsing Panel, the Model TTS 26BXC-4 is able to test switches in step-by-step systems. Jacks are provided to access the circuits established by the switches, and the pulsing and measuring circuits of the Model TTS 26B. A dial is also provided that can be patched to the EXT DIAL jack or binding posts of the Model TTS 26B.

1.3 The Model TTS 26BXC-4 is mounted in the detachable accessory cover of the Model TTS 26B. Power and interconnections between the Model TTS 26BXC-4 and the Model TTS 26B are provided through patch cords (not supplied) and a five-pin lock-in connector and cable provided with the cover. Unless otherwise specified, tip and ring two-conductor cables are satisfactory for interconnections between this unit and the Model TTS 26B. Tip, ring and sleeve cables can be used for all interconnections.

SECTION 2

SPECIFICATIONS

2.1 INTRODUCTION.

2.2 Table 2-1 lists the specifications for the Model TTS 26BXC-4 Circuit Panel Accessory.

Table 2-1. Model TTS 26BXC-4 Circuit Panel Accessory Specifications.

Test Circuits	12 different test circuits inserted between the pulsing circuit of the TTS 26B and the circuit under test.
Loop Resistance	Balanced loop resistance of 0 to 4000 ohms in 200-ohm increments inserted between the loop pulsing circuit of the TTS 26B and the circuit under test.
"A" Relay Resistance	Adjustable in fixed steps of 1200,2800 and 4400 ohms with a continuous range of adjustment of 0 to 1600 ohms between the fixed values of resistance.
Overall Dimensions	14 in. w x 10 in. h x 6 in. d (31.6 cm w x 25.4 cm h x 15.2 cm d).
Weight	10 pounds (4.54 kg).

SECTION 3

OPERATING INSTRUCTIONS

3.1 **INTRODUCTION.**

3.2 This section provides the information needed to operate the Model TTS 26BXC-4. Visual inspection is covered in paragraphs 3.3 and 3.4. Operating instructions are provided in paragraphs 3.5 through 3.40.

3.3 **VISUAL INSPECTION.**

3.4 After unpacking the unit, examine the exterior for visual damage or loose components due to shipment.

3.5 **OPERATION.**

3.6 The functions of all front panel connectors, controls and indicators are described in Table 3—1. The connectors, controls and indicators are identified on Figure 3—1.

3.7 **NORMAL CONTROL SETTINGS.**

3.8 CIRCUIT switch S4 provides various leak, loop and test circuits required for testing pulse repeaters and step-by-step switches. These circuits, as shown on Figure 3—2 are described below:

a. NORM Provides connection through switch S5 between R LP SX RLY jack J2 and TO TTS 26 SEND jack J5.

b. LKA Provides a leak of 10,250 ohms in parallel with, 5050 ohms in series with 2.15 uF, between R LP SX RLY jack J2 and TO TTS 26 SEND jack J5.

c. LKB Provides a leak of 10,250 ohms between any inserted loop resistance in the connection between R LP SX RLY jack J2 and TO TTS 26 SEND jack J5.

d. LKC Provides a leak of 10,250 ohms in parallel with, 600 ohms in series with 2.15 uF, between any inserted loop resistance in the connection between R LP SX RLY jack J2 and TO TTS 26 SEND jack J5.

e. LKD Provides a leak of 20,250 ohms in parallel with, 600 ohms in series with 2.15 uF, between R LP SX RLY jack J2 and TO TTS 26 SEND jack J5.

f. LKD-1 Provides a leak of 1000 ohms in series with 0.65 uF between any inserted loop resistance in the connection between R LP SX RLY jack J2 and TO TTS 26 SEND jack J5.

g. RLY Provides a leak of 600 ohms in series with 2.15 uF between any inserted loop resistance in the connection between R LP SX RLY jack J2 and TO TTS 26 SEND jack J5. A receiving circuit is also established between the sleeve of J2 and the tip of TO TTS 26 REC jack J6.

h. SX Provides 450 ohms in series with the tip and 450 ohms in series with the ring between any inserted loop resistance in the connection between R LP SX RLY jack J2 and TO TTS 26 SEND jack J5. Both resistors are connected in parallel to the tip of J5. A leak-to-ground of 600 ohms in series with 4 uF is also connected to the tip and the ring is grounded. Tip-ring reversal is provided in the connection between the tip and ring of B LP IN jack J3 and TO TTS 26 REC jack J6 through the circuits of REC CKT and "A" RELAY switches S2 and S3.

i. LP Provides a leak of 600 ohms in series with 2.15 uF between any inserted loop resistance in the connection between R LP SX RLY jack J2 and TO TTS 26 SEND jack J5. Tip-ring reversal of B LP IN jack J3 and TO TTS 26 REC jack J6 through REC CKT and "A" RELAY switches S2 and S3.

j. RCX Provides the sending and receiving circuits required for testing composite signaling circuit relays. The sending circuit is obtained at RCX jack J4 and the receiving circuit is connected to R LP SX RLY jack J2. The TTS 26B SEND 1 or SEND 2 jack is patched to TO TTS 26 SEND jack J5 on the TTS 26BXC-4. The TTS 26B REC LOOP jack is patched to TO TTS 26REC jack J6 on the TTS 26BXC-4.

k CT Inserts resistor R46 across the tip and ring of TO TTS 26 REC jack J6. This lowers the effective meter impedance to provide

Table 3—1. Connectors,Controls and Indictors.

REF DESIG	CONNECTOR,CONTROL OR INDICATOR	FUNCTION
J1	RLY-1 jack	Connection for pulsing signal output to circuit under test through tip and ring of a 310-type connector when there is an input signal to be measured on the sleeve.
J2	R LP SX RLY jack	Connection for pulsing signal output to circuit under test through tip, ring and sleeve of a 310-type connector.
J3	B LP IN jack	Connection for input signals from circuit under test that use the "A" relay on tip and ring of a 310-type connector.
J4	RCX jack	Connection for pulsing signal output to a RCX-type circuit through tip,ring and sleeve of a 310-type connector.
J5	TO TTS 26 SEND jack	Connection for loop pulsing signal of Model TTS 26B LOOP SIGNALING, SEND 1 or SEND 2 jack to the unit through tip and ring of a 310-type connector.
J6	TO TTS 26 REC jack	Connection for input signal from circuit under test to LOOP SIGNALING, REC LOOP jack on Model TTS 26B through tip and ring of a 310-type connector.
J7	DIAL jack	Connection for dial switch J8 to EXT DIAL jack or binding posts on Model TTS 26B.
PL1	BUSY lamp	When lit, indicates guard relay K2 in sleeve circuit of R LP SX RLY jack J2 is activated.
PL2	SLEEVE lamp	When lit, a ground is applied to sleeve of B LP IN jack J3.
R45	0-1600 ADJ potentiometer	Allows "A" relay resistance to be adjusted continuously between steps of "A" RELAY RESISTANCE switch S6.
S1	ADD 1500, 2000 switch	Adds either 1500 or 2000 ohms to LOOP RESISTANCE switch S5.
S2	"A" RELAY switch	When set to A, B or C, establishes one of three "A" relay configurations to simulate remote end of circuit to be tested.
S3	REC CKT switch	When set to position 1, 2 or 3 establishes one of three circuit configurations in conjunction with "A" relay switch S2 to be used with CIRCUIT switch S4 in SX or LP positions.

Table 3—1. (cont'd).

REF DESIG	CONNECTOR, CONTROL OR INDICATOR	FUNCTION
S4	CIRCUIT switch	When set, provides various leak, loop and test circuits required for testing pulse repeaters and step-by-step switches. Refer to Figure 3—2 for test configurations.
S5	LOOP RESISTANCE switch	When set, provides loop resistances of 0 to 2000 ohms in 200-ohm increments.
S6	"A" RELAY RESISTANCE switch	When set, provides balanced loop resistances of 0, 1200, 2800 or 4000 ohms to "A" relay.
S7	SL switch	When set, applies ground to sleeve of RLY-1 jack J1.
S8	Telephone Dial	Manual pulse train control.

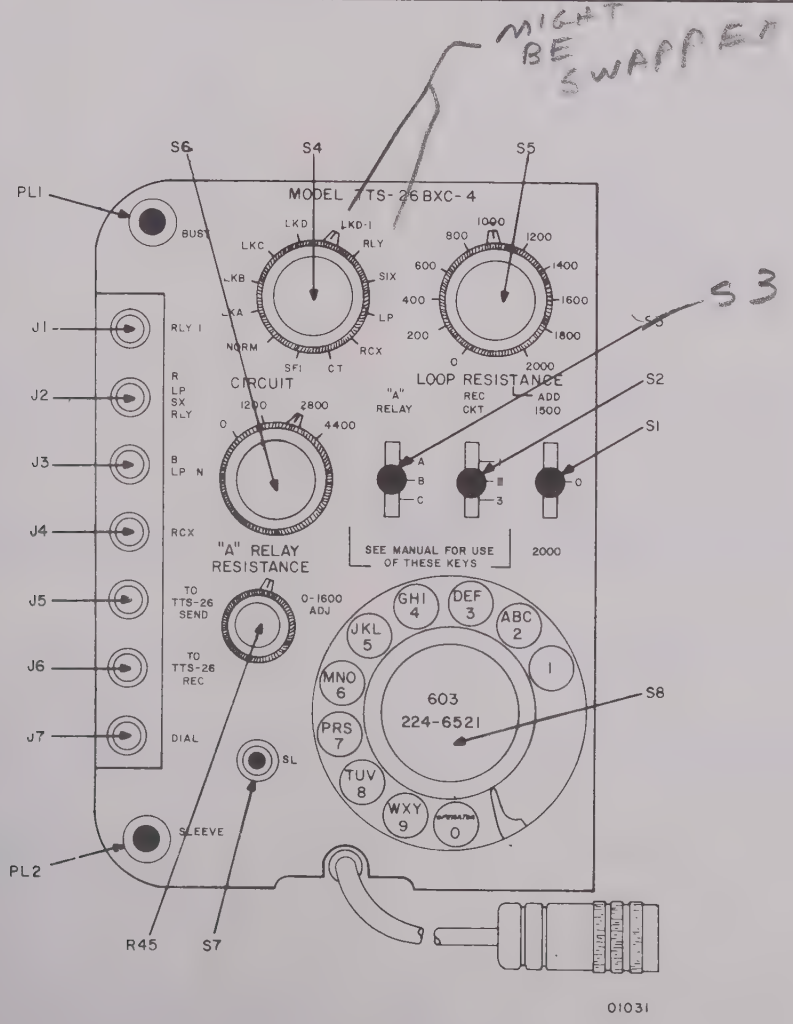


Figure 3—1. TTS 26BXC-4 Front Panel Connectors, Controls and Indicators.

an accurate reading over a wide range of loop resistances when measuring or simulating loop resistances.

I. SF-1. Provides a leak of 15,000 ohms in parallel with, 600 ohms in series with 2.15 uF, between any inserted loop resistance in the connection between R LP SX RLY jack J2 and TO TTS 26 SEND jack J5. A non-inverted connection is provided between the tip and ring of B LP IN jack J3 and TO TTS 26 REC jack J6 through REC CKT and "A" RELAY switches S2 and S3.

3.9 LOOP RESISTANCE switch S5 provides balanced loop resistances from 0 through 2000 ohms in 200-ohm increments. Associated ADD switch S1 provides either 1500 or 2000 ohms of added balanced resistance to provide up to 4000 ohms of balanced loop resistance.

3.10 The "A" RELAY switches and control provide use of the "A" relay circuits to simulate the remote end of the circuit to be tested. The windings of the "A" relay may be connected to the pulsing of the circuit under test through balanced loop resistances controlled by "A" RELAY RESISTANCE switch S6 and associated 0-1600 ADJ potentiometer R45 and "A" RELAY switch S3. A fixed position of 1200 ohms on S6 is a convenient setting when testing and adjusting the internal "A" relay.

3.11 REC CKT switch S2 and "A" RELAY switch S3 establish the circuit configurations required for tests made using CIRCUIT switch S4 in the SX or LP position. These circuit configurations are shown on Figure 3–2. Switches S2 and S3 in conjunction with S4, set in the NORM or LK positions, are also used to duplicate operating conditions of the circuit under test.

3.12 SL switch S7 applies a ground to the sleeve of RLY-1 jack J1 to prevent seizure of the circuit between tests.

3.13 CIRCUIT, REC CKT AND "A" RELAY SWITCH APPLICATIONS.

3.14 CIRCUIT switch S4, REC CKT switch S2 and "A" RELAY switch S3 are used to establish the following circuit configurations:

a. With the RECEIVE switch on the TTS 26B in the LOOP position, CIRCUIT switch S4 on the TTS 26BXC-4 in the NORM or any of the LK positions, REC CKT switch S2 in position 3 and the "A" RELAY switch in position B, the "A" relay is connected to the pulsing contacts of the circuit under test to simulate operating conditions. Loop resistance may be added in series with the "A" relay coils by use of "A" RELAY RESISTANCE switch S6 and 0-1600 ADJ control R45 to simulate normal loop resistance to a distant office. The pulsing contact of the "A" relay then applies open and ground pulses to the TTS 26B through the patch from TO TTS 26 REC jack J6 on the TTS 26BXC-4 to the REC LOOP jack on the TTS 26B.

b. With CIRCUIT SWITCH S4 in the NORM or any of the LK positions, REC CKT switch S2 in position 1 and "A" RELAY switch S3 in position B, the received pulsing signal from the sleeve of RLY-1 jack J1 on the TTS 26BXC-4 is connected to the tip of TO TTS 26 REC jack J6.

c. With CIRCUIT switch S4 in the NORM or any of the LK positions, REC CKT switch S2 in position 2 and "A" RELAY switch S3 in the position A, the "A" relay is connected across the tip and ring of TO TTS 26 REC jack J6 on the TTS 26BXC-4. "A" RELAY RESISTANCE switch S6 and 0-1600 ADJ control R45 are adjusted as described. The METER CIRCUIT switch on the TTS 26B must be in the % BREAK DIRECT position. The "A" relay with its adjustable series coil resistance simulates the load across the pulsing contacts of the circuit under test.

d. With CIRCUIT switch S4 in the NORM or any of the LK positions, REC CKT switch S2 in position 2 and "A" RELAY switch S3 in position B, the tip and ring of B LP IN jack J3 is connected straight through to the tip and ring of TO TTS 26 REC jack J6. If the % BREAK meter on the TTS 26B indicates close to full scale when measuring circuits of several hundred ohms or less, CIRCUIT switch S4 should be set to the CT position.

e. With CIRCUIT switch S4 in the NORM or any of the LK positions, REC CKT switch S2 in position 3, the "A" RELAY switch in position C and the TTS 26B in the RECEIVE LOOP position, the "A" relay is connected to the pulsing contacts of the circuit under test. Operating conditions are simulated with no loop resistance in series with the coils of the "A" relay. The pulsing contact of the "A" relay then applies open and ground pulses to the TTS 26B through a patch from TO TTS 26 REC jack J6 on the TTS 26BXC-4 to the REC LOOP jack on the TTS 26B.

3.15 OPERATION.

3.16 The Model TTS 26B should be put into an operating condition in accordance with the instructions

in the Model TTS 26B manual. For most applications, the RECEIVE switch should be in the LOOP position and the SEND switch in the SEND LOOP REC LOOP position. To prepare the Model TTS 26BXC-4 for operation, perform the following steps:

ACTION	RESULT
a. Connect 5-pin, lock-in type connector cable from Model TTS 26BXC-4 to EXTERNAL ADAPTER on Model TTS 26B.	Supplies 48 volt battery and essential interconnections between Model TTS 26BXC-4 and Model TTS 26B
b. With a 310-type connector cable, patch SEND 1 or SEND 2 jack of Model TTS 26B to TO TTS 26 SEND jack J5 on Model TTS 26BXC-4.	
c. When incoming pulses are to be received through Model TTS 26BXC-4, TO TTS 26 REC jack J6 should be patched to REC LOOP jack on the Model TTS 26B using a 310-type connector cable.	In most cases, RECEIVE switch on Model TTS 26B should be in the LOOP position. When wet loop pulsing, the RECEIVE switch should be in B&G ON LOOP position.

3.17 **TO SEND SIGNALS.**

3.18 To send signals perform the following steps:

ACTION	RESULT
a. Adjust Model TTS 26B to supply desired pulse speed and % break.	
b. With CIRCUIT switch S4, select desired test circuit of Model TTS 26BXC-4.	Except for the RCX position, the circuit under test is connected to R LP SX RLY jack J2. Leak resistances are added by CIRCUIT switch S4 in various configurations and values.
c. With LOOP RESISTANCE and ADD switches S5 and S1, select desired amount of loop resistance.	Switch S5 adjusts loop resistance in 200-ohm steps. Switch S1 adds either 1500 or 2000 ohms of loop resistance.
d. Set SL switch S7 to down position.	Applies ground to sleeve of RLY-1 jack J1 to prevent seizure of circuit between tests.
e. If the RCX position of CIRCUIT switch S4 is used, the circuit under test is connected to tip and ring of RCX jack J4.	LOOP RESISTANCE switch S5 and associated ADD switch S1 are not in test circuit in this position.

3.19 **TO RECEIVE SIGNALS.**

3.20 To receive signals perform the following steps:

ACTION	RESULT
a. Connect received pulsing signals to either R LP SX RLY jack J2, RLY-1 jack J1 or B LP IN jack J3 on TTS 26BXC-4.	Various circuit configurations are established by CIRCUIT switch S4, REC CKT switch S2 and "A" RELAY switch S3.

ACTION	RESULT
b. Simultaneous sending and receiving is possible in the RLY, SX, LP, RCX and SF-1 positions of CIRCUIT switch S4.	Refer to Figure 3—2.

3.21 **CX CIRCUIT TESTING.**

3.22 Two methods of testing CX circuits, using the TTS 26B Pulse Signaling Test Set equipped with a TTS 26BXC-4 circuit panel, are described below. Refer to Figures 3—3 and 3—4.

3.23 **SINGLE CIRCUIT TESTING.**

3.24 To test CX type signaling circuits in a straightaway method with the input at the M lead of one end of a signaling section and the output at the E lead of the other end, perform the following:

ACTION	RESULT
a. Set RECEIVE switch on TTS 26B to extreme clockwise position.	Allows SEND switch to control both send and receive circuits.
b. Set SEND switch on TTS 26 B to LINE E&M position.	Refer to TTS 26B instruction manual, section 3, for TTS 26B operating instructions.
c. Connect 5-pin plug from TTS 26BXC-4 to EXTERNAL ADAPTER connector on TTS 26B.	
d. On TTS 26BXC-4, patch TO TTS 26 SEND jack J5 to LINE jack on TTS 26B.	
e. On TTS 26BXC-4, patch TO TTS 26 REC jack J6 to E jack on TTS 26B.	
f. On TTS 26BXC-4, patch RLY-1 jack J1 to PLS or C jack on CX circuit.	
g. On TTS 26BXC-4, set CIRCUIT switch S4 to NORM position and REC CKT switch S2 to position 1.	TTS 26B is now set up to send and receive pulses.

3.25 Dial pulsing on CX signaling circuits is normally at the rate of 10 pulses per second. Tests for dial pulse distortion, however, are made at 12 pulses per second. For typical limits for adjusting, testing and performance in terms of % break at this rate, refer to Table 3—2.

3.26 **BACK-TO-BACK CIRCUIT TESTING.**

3.27 To test CX type signaling circuits in a back-to-back method with the input at the M lead of one end of a signaling section and the output at the E lead of the other end, perform the following:

ACTION	RESULT
a. On TTS 26B, set RECEIVE to extreme clockwise position.	Allows SEND switch to control both send and receive circuits.
b. On TTS 26B, set SEND switch to LINE E&M position.	Refer to TTS 26B instruction manual, section 3, for TTS 26B operating instructions.

ACTION	RESULT
c. Connect 5-pin plug from TTS 26BXC-4 to EXTERNAL ADAPTER connector on TTS 26B.	
d. At main distributing frame (MDF) connect two CX circuits together in a back-to-back manner.	
e. Patch LINE jack on TTS 26B to PLS or C jack of CX circuit number one.	
f. On TTS 26B, patch the E jack to TO TTS 26 REC jack J6 on TTS 26BXC-4.	
g. On TTS 26BXC-4, patch R LP SX RLY jack J2 to PLS or C jack of CX circuit number two.	
h. On TTS 26BXC-4, set CIRCUIT switch S4 to RCX position. All other switches should be in their normal positions.	TTS 26B is now set up to send pulses on circuit number one and receive pulses on circuit number two.
i. Reverse connections from TTS 26B to PLS or C jack of CX circuits.	TTS 26B is now set up to send pulses on circuit number two and receive pulses on circuit number one.

Table 3—2. % Break-Adjust, Test and Performance

	% Break Input	Output	Pulsing Speed
Adjust	58	59	12 pps
Test	58	57—61	12 pps
Performance	58	55—63	12 pps

3.28 Dial pulsing on CX signaling circuits is normally at the rate of 10 pulses per second. Tests for dial pulse distortion, however, are made at 12 pulses per second. For typical limits for adjusting, testing and performance in terms of % break at this rate, refer to Table 3—2.

3.29 % BREAK METHOD FOR PULSING TESTS OF OUTGOING REPEATERS.

3.30 While the pulsing tests covered under the following paragraphs are an alternative to the overall pulsing tests, they do not completely replace them.

3.31 In order to ensure reliability in the following test, it is imperative that the % break meter on the TTS 26B Pulse Signaling Test Set be properly calibrated and the pulsing relay within the TTS 26BXC-4 Circuit Panel be properly adjusted to standard "A" relay requirements in Section 5. Test and calibration procedures for the TTS 26B meter are found in Section 5 of the TTS 26B Instruction manual.

3.32 The % break limits shown on the circuit requirement tables are those necessary to ensure correct operation under the most adverse circuit conditions. These limits should be employed in initial tests of circuits to which they apply and all subsequent readjustments should be made to those limits. To avoid unnecessary adjustments when % break tests are applied on a routine basis, however, use test limits three higher than the maximum value specified and three lower than the minimum value specified.

3.33 The 1200-ohm loop and leak A conditions specified for use with the % break measurements are intended to provide an adjustment of the pulse repeating relay to give minimum pulse distortion under conditions encountered on the outgoing trunks with associated repeaters. Therefore, these loop and leak conditions may not be the same as those specified for making overall pulsing test of repeaters, selecters and converters in the same office.

CAUTION

Care should be taken to see that out-trunk switches are not held busy when the repeaters are made busy.

3.34 When testing repeaters having trunks to a call indicator office, the call indicator trunk group make-busy key should be in the normal position in order not to interfere with tests. Where the repeater is preceded by a plunger-type out-trunk switch, the repeater should be made busy in the approved manner before performing these tests. The associated master switch should be rotated to pick up disengaged plungers.

3.35 If these tests are performed during periods of light traffic, the tests can be expedited by busying several reperaters at one time or by making the master switch busy where the repeaters are preceded by plunger-type out-trunk switches.

3.36 The following detailed methods assume that the repeaters are equipped with outgoing tip and ring conductors terminated on 6-spring test jacks. If the conductors do not terminate at the test jacks, it is necessary to provide a suitable connecting cord for attaching to the tip and ring conductors at the repeater shelf jack springs.

NOTE

The test equipment specified is designed to apply proper marginal tests, simulated critical circuit conditions, when the circuits under test and the test equipment have an applied voltage of 48.5 to 50 volts. The battery voltage should be reduced, if permissable, and maintained within the required limits while tests are being made.

3.37 **TEST EQUIPMENT REQUIRED.**

3.38 For test equipment required at outgoing office and at incoming office refer to Tables 3—3 and 3—4.

Table 3—3. Equipment Required at Outgoing Office.

TTS 26B Pulse Signaling Test Set
TTS 26BXC-4 Circuit Panel
TTS 26BXP Pulsing Panel
TTS 26BXPC Remote Control Unit for TTS 26BXP
1011G Headset equipped with W2CL cord, 471A jacks and 240A plug (2W39A cord) or equivalent.
Two patch cords, P3E cord 4 feet long equipped with two 310 plugs (3P7E cord) or equivalent.
Patch cord, P3K cord or equivalent, 12 feet long with two 310 plugs (3P15B cord).
Two patch cords, P3H cords or equivalent 5 feet long with red shelled 310 plug, one black shelled 310 plug and one 240 plug (6P3A cord). It is necessary to modify this cord by reversing tip and ring conductors of plug with black shell.

Table 3—4. Equipment Required at Incoming Office.

1011G Handset equipped with W2CL cord, 471A jack, and 240A plug (2W39A cords) or equivalent.
258C or 258B make busy plugs or equivalent as required.

3.39 **TEST PROCEDURE.**

3.40 Perform the following steps for the % Break Method for Pulsing of Outgoing Repeaters and refer to Figures 3—5 through 3—7 for step 1 through step 3 hook-up diagrams.

ACTION	RESULT
a. Prepare TTS 26B for operation as described in TTS 26B instruction manual.	
b. Prepare TTS 26BXP for operation as described in TTS 26BXP instruction manual.	
c. Connect TTS 26BXPC Remote Control unit to jacks A and B on TTS 26BXP. Position notched side of plug toward jack A.	
d. Using two patch cords, patch REC LOOP jack on TTS 26B to TO TTS 26B REC jack J6 on TTS 26BXC-4 panel and SEND RELAY jack on TTS 26B to SND RLY jack on TTS 26BXP.	
e. Insert red shell and black shell plugs of modified 6P3A cords into R jack J2 and B jack J3 respectively on TTS 26BXC-4.	
f. On TTS 26B, set RECEIVE switch to B&G ON LOOP position.	
g. Using 1011G handset and idle trunk, establish talk connection to distant office.	
h. Insert 240B plug of modified 6P3A cord assembly into test jack of repeater.	TTS 26BXC-4 BUSY lamp PL1 does not light. **NOTE** **If BUSY lamp PL1 lights, remove 240B plug and proceed to another repeater.**
i. On TTS 26BXC-4, set SL switch to down position.	
j. On TTS 26BXC-4, set REC CKT switch S2 to position 2, "A" RELAY switch S3 to position B and CIRCUIT switch S4 to NORM. Refer to Figure 3—5 for step 1 hook-up diagrams.	Record deflection observed on % break meter. If a low indication is observed, i.e., 25% break or less, this indicates a short loop and CIRCUIT switch S4 should be set to CT position and a new indication recorded.
k. On TTS 26BXC-4, set "A" RELAY switch S3 to position A. Refer to Figure 3—6 for step 2 hook-up diagram.	Deflection observed on % break meter should be same as step j. If meter deflection is not the same, adjust "A" RELAY RESISTANCE switch S6 and 0-1600 ADJ control R45 until same indication is observed. If CT position was used in step j, it should be used here also.
l. On TTS 26BXC-4 set "A" RELAY switch S3 to position B and REC CKT switch S2 to position 3.	

ACTION	RESULT
m. At distant office, remove battery and ground from trunk of repeater under test. In step-by-step office, this may be done by inserting 477A or 375A make-busy tool between S and G springs of test jack and raising shaft off-normal. In call indicator office, this may be done by inserting a 358B or 258B make-busy plug into the trunk test jack. If tip and ring conductors are not opened, use other suitable means dependent upon particular circuit arrangements.	
n. On TTS 26B, set RECEIVE switch to LOOP position and SEND switch to SEND LOOP REC G&B position.	
o. On TTS 26BXP, set CAL % BRK switch to PR position.	
p. On TTS 26BXC-4, set CIRCUIT switch S4 to LKA position and LOOP RESISTANCE switch S5 to 1200.	
q. On TTS 26BXPC, momentarily depress LP switch. Refer to Figure 3—7 for step 3 test hook-up diagram.	Test set pulses continuously. % break meter indication holds steady not exceeding upper limit of circuit requirement tables. Refer to paragraph 3.32. An unstable indication may be the result of "B" relay failing to hold. Return CAL % BRK switch on TTS 26BXP to normal for one second and recheck indication. If indication is still unstable due to failure of "B" relay to hold under conditions of continuous pulsing, hold "B" relay operated manually while taking reading.
r. On TTS 26BXPC, momentarily depress RLS switch.	All pulsing stops. % break meter returns to normal.
s. On TTS 26BXPC, momentarily depress LK switch.	Test set pulses continuously. % break meter holds steady at not less than lower limit. Refer to paragraph 3.32. An unstable indication may be the result of "C" relay failing to hold. In such a case hold "C" relay operated manually while taking reading. Adjustment of "C" relay should be checked before placing repeater in service.
t. On TTS 26BXPC, momentarily depress RLS switch.	All pulsing stops. % break meter returns to normal.
u. Unless further tests are to be made, return all switches and equipment to normal.	

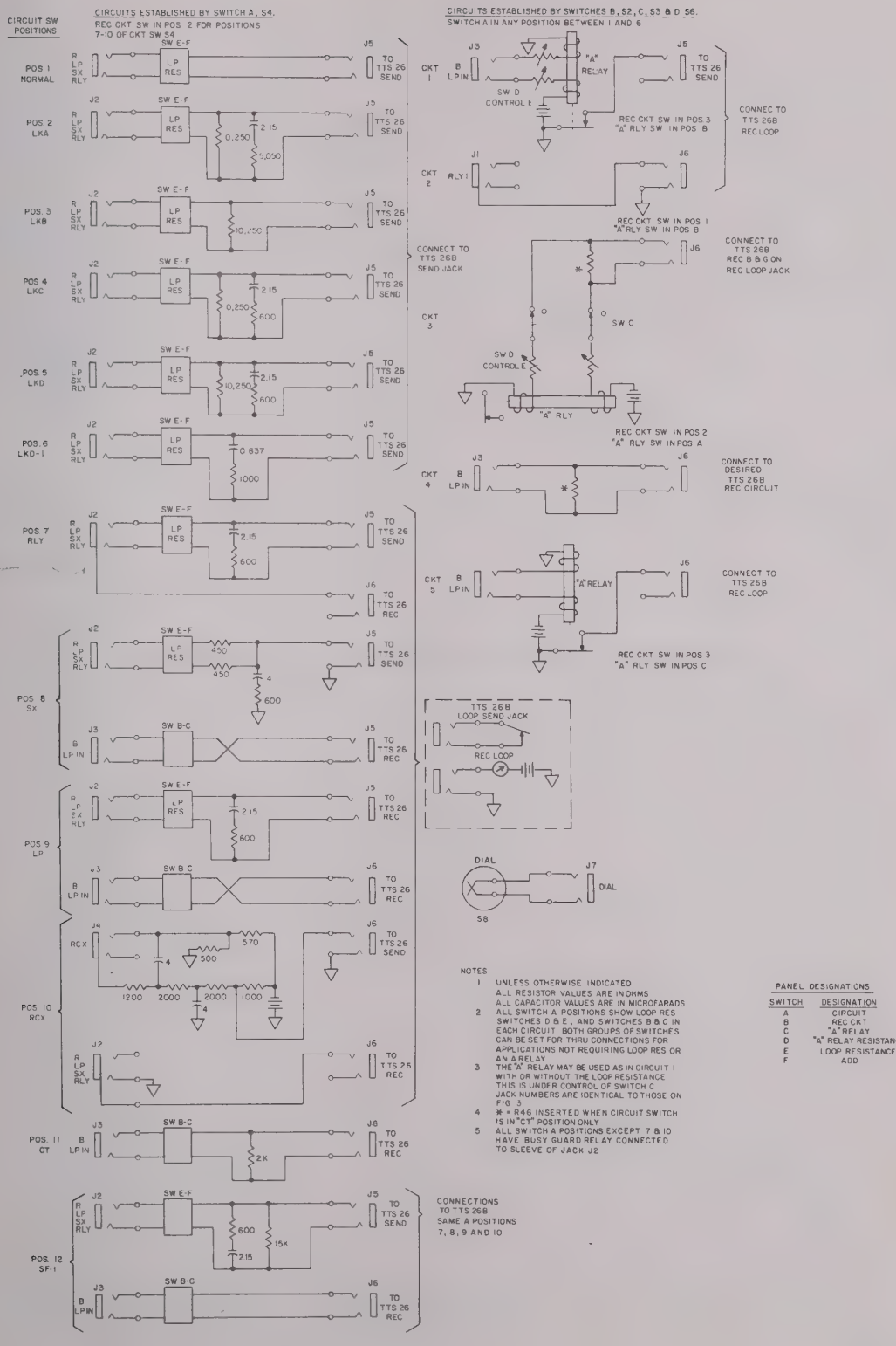

CIRCUIT SW POSITIONS
CIRCUITS ESTABLISHED BY SWITCH A, S4.
REC CKT SW IN POS. 2 FOR POSITIONS 7-10 OF CKT SW S4
CIRCUITS ESTABLISHED BY SWITCHES B, S2, C, S3 & D, S6.
SWITCH A IN ANY POSITION BETWEEN 1 AND 6
POS 1 NORMAL
POS 2 LKA
POS 3 LKB
POS 4 LKC
POS 5 LKD
POS 6 LKD-1
POS 7 RLY
POS 8 SX
POS 9 LP
POS 10 RCX
POS 11 CT
POS 12 SF-1
SW E-F
LP RES
TO TTS 26 SEND
TO TTS 26 REC
SW B-C
CKT 1 B LP IN
"A" RELAY
SW D CONTROL E
REC CKT SW IN POS 3 "A" RLY SW IN POS B
CONNEC TO TTS 26B REC LOOP
CKT 2 RLY 1
REC CKT SW IN POS 1 "A" RLY SW IN POS B
CONNECT TO TTS 26B SEND JACK
CONNECT TO TTS 26B REC B & G ON REC LOOP JACK
CKT 3
SW C
"A" RLY
REC CKT SW IN POS 2 "A" RLY SW IN POS A
CKT 4 B LP IN
CONNECT TO DESIRED TTS 26B REC CIRCUIT
CKT 5 B LP IN
"A" RELAY
CONNECT TO TTS 26B REC LOOP
REC CKT SW IN POS 3 "A" RLY SW IN POS C
TTS 26B LOOP SEND JACK
REC LOOP
DIAL
J7
S8
CONNECTIONS TO TTS 26B SAME A POSITIONS 7, 8, 9 AND 10
NOTES
1 UNLESS OTHERWISE INDICATED ALL RESISTOR VALUES ARE IN OHMS ALL CAPACITOR VALUES ARE IN MICROFARADS
2 ALL SWITCH A POSITIONS SHOW LOOP RES SWITCHES D & E, AND SWITCHES B & C IN EACH CIRCUIT BOTH GROUPS OF SWITCHES CAN BE SET FOR THRU CONNECTIONS FOR APPLICATIONS NOT REQUIRING LOOP RES OR A N A RELAY
3 THE "A" RELAY MAY BE USED AS IN CIRCUIT 1 WITH OR WITHOUT THE LOOP RESISTANCE THIS IS UNDER CONTROL OF SWITCH C JACK NUMBERS ARE IDENTICAL TO THOSE ON FIG 3
4 * = R46 INSERTED WHEN CIRCUIT SWITCH IS IN "CT" POSITION ONLY
5 ALL SWITCH A POSITIONS EXCEPT 7 & 10 HAVE BUSY GUARD RELAY CONNECTED TO SLEEVE OF JACK J2
PANEL DESIGNATIONS
SWITCH DESIGNATION
A CIRCUIT
B REC CKT
C "A" RELAY
D "A" RELAY RESISTANCE
E LOOP RESISTANCE
F ADD
01042

Figure 3—2. TTS 26BXC-4 Simplified Schematic Diagrams of Available Circuits.

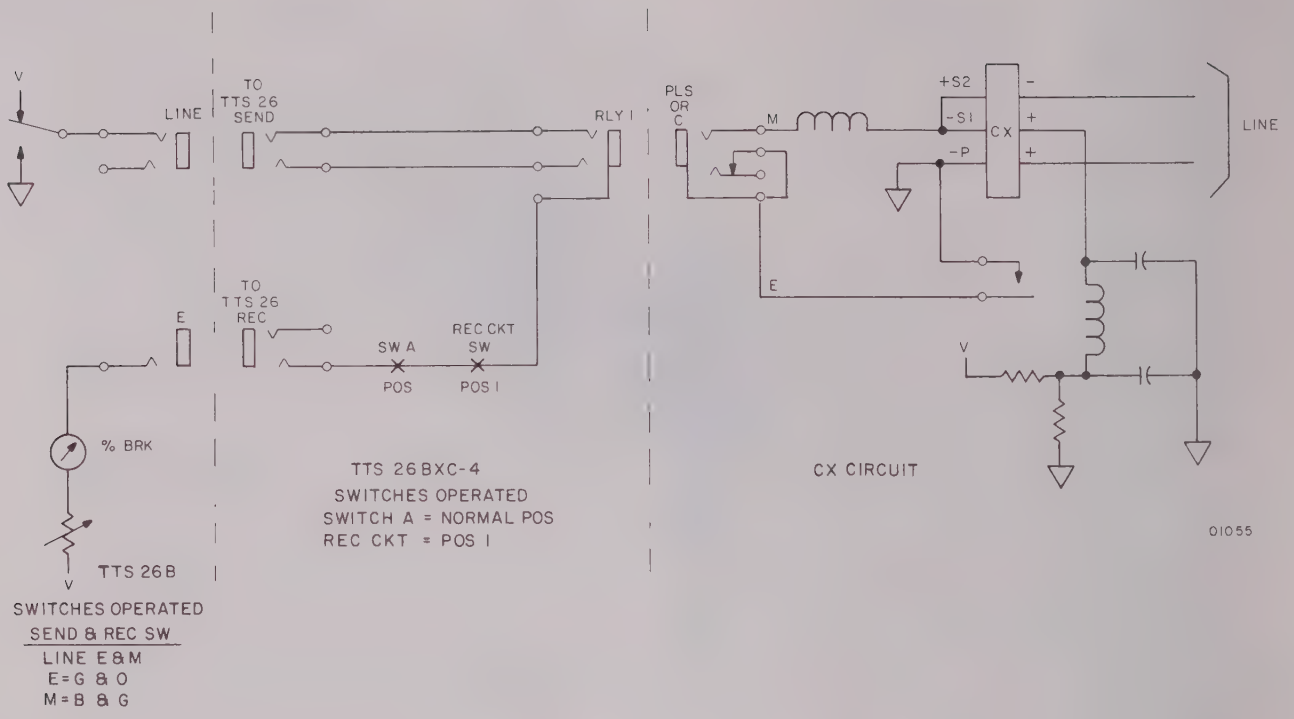


Figure 3—3. TTS 26BXC-4 Single CX Circuit Testing Arrangement.

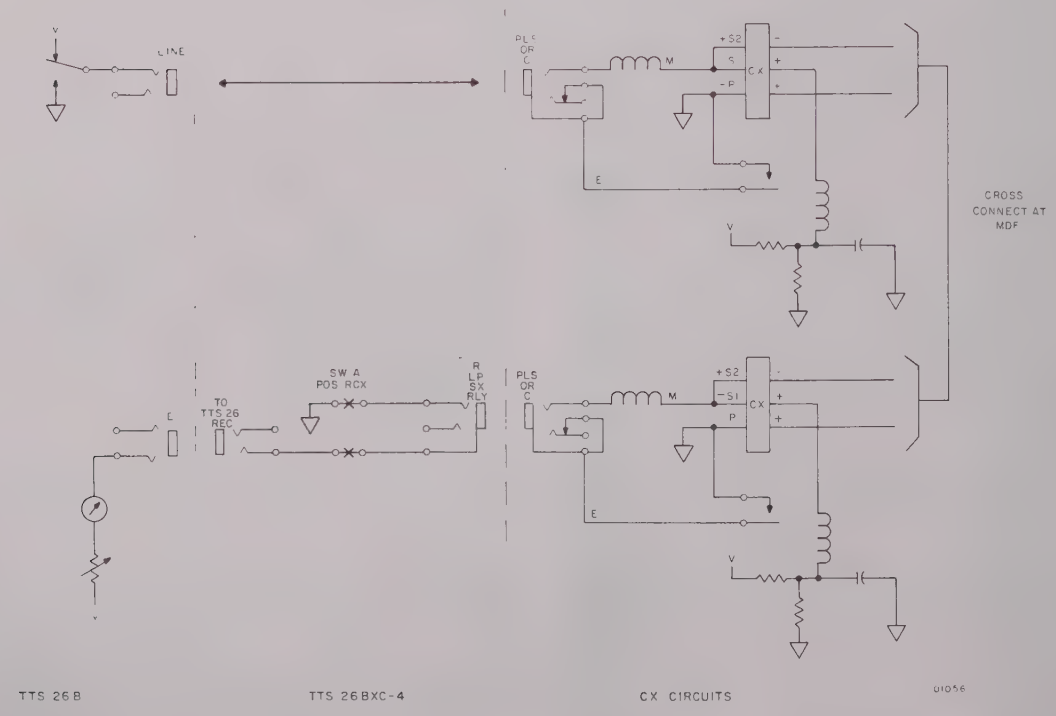


Figure 3—4. TTS 26BXC-4 Back-to-Back CX Circuit Testing Arrangement.

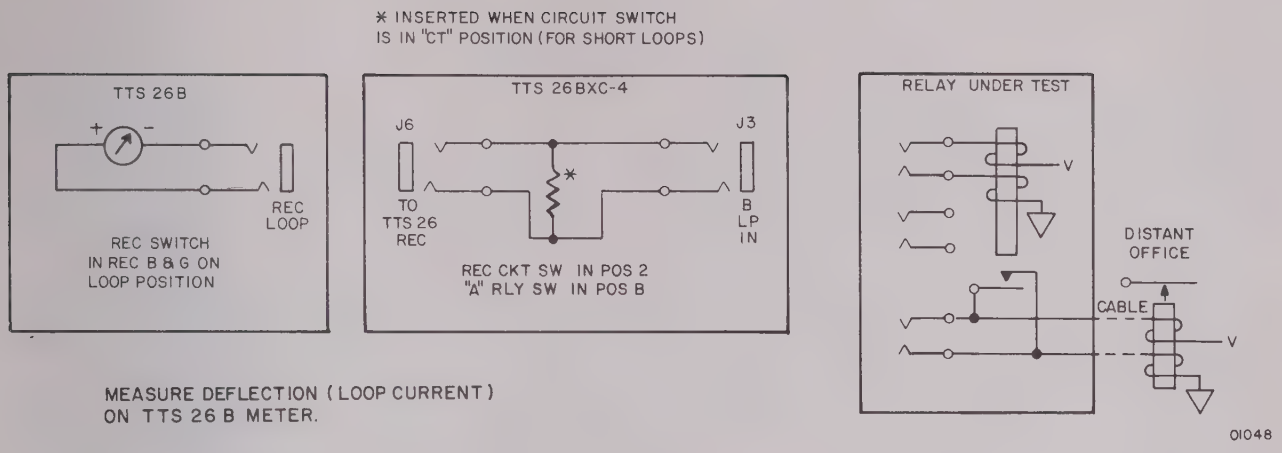


Figure 3—5. TTS 26BXC-4 % Break Method for Pulsing Tests of Outgoing Repeaters, Step 1.

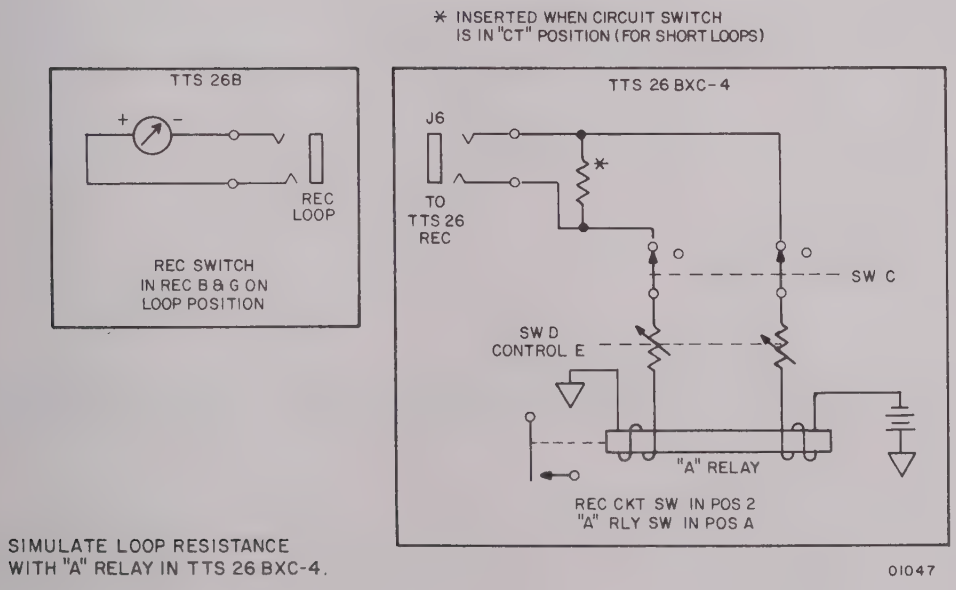
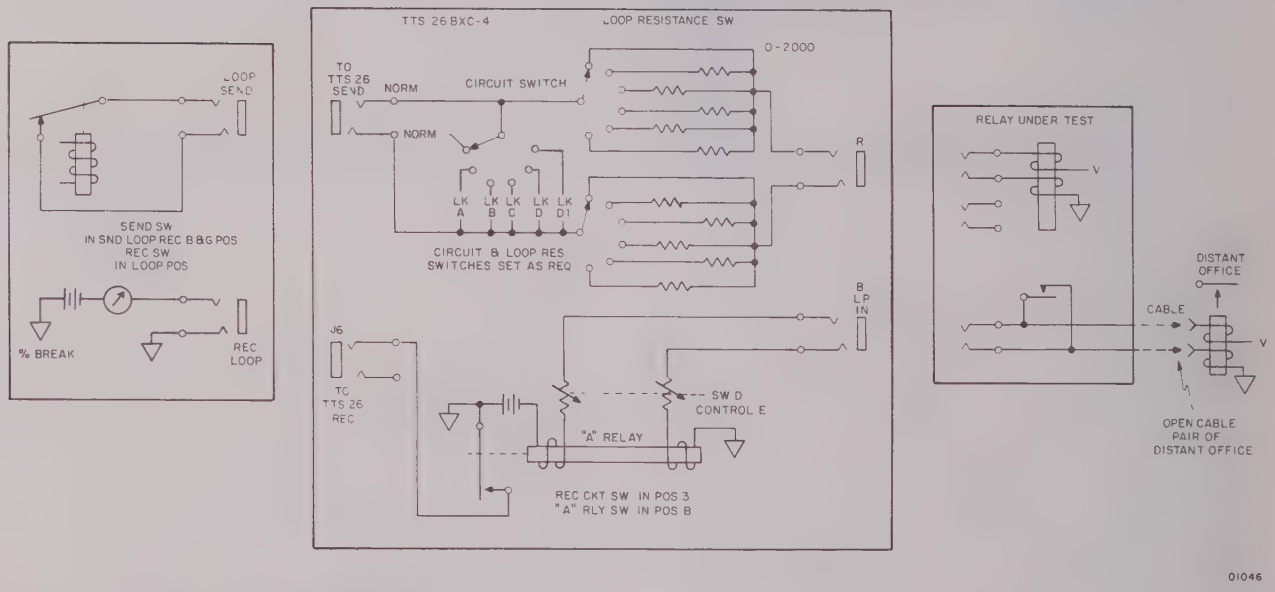


Figure 3—6. TTS 26BXC-4 % Break Method for Pulsing Tests of Outgoing Repeaters, Step 2.



PULSE RELAY UNDER TEST, "A" RELAY IN TTS 26 BXC-4 SIMULATES DISTANT "A" RELAY WITH SIMULATED LOOP RESISTANCE. MEASURE % BRK ON TTS 26 BXC-4 "A" RELAY CONTACTS.

Figure 3—7. TTS 26BXC-4 % Break Method for Pulsing Tests of Outgoing Repeaters, Step 3.

SECTION 4

CIRCUIT DESCRIPTION

4.1 **INTRODUCTION.**

4.2 The available test circuits of the Model TTS 26BXC-4 are shown on Figure 3—2 and the schematic diagram, Figure 7—1.

4.3 CIRCUIT switch S4 and LOOP RESISTANCE switch S5 are associated with the pulse sending functions of the Model TTS 26B Pulse Signaling Set. The range of LOOP RESISTANCE switch S5 can be extended by the setting of associated ADD switch S1. The circuits available by use of these switches are inserted between R LP SX RLY jack J2 and TO TTS 26 SEND jack J5 when CIRCUIT switch S4 is in the NORM or any of the LK positions. If CIRCUIT switch S4 is in any of these positions and a ground is provided on the sleeve of R LP SX RLY jack J2, guard relay K2 operates, the circuit is disconnected from the pulsing source and BUSY lamp DS1 lights.

4.4 The loop pulsing signal from the LOOP SIGNALING SEND 1 or 2 jack on the TTS 26B is patched to TO TTS 26 SEND jack J5 on the TTS 26BXC-4 using a tip-ring cord equipped with a 310-type connector on each end. The pulsing signal output from the TTS 26BXC-4 is patched from R LP SX RLY jack J2 to the circuit under test using a tip-ring-sleeve cord equipped with a 310-type connector on the TTS 26BXC-4 end. The output signal is also available at the tip and ring of RLY-1 jack J1. When an RCX type circuit is to be pulsed, that circuit is patched to RCX jack J4 on the TTS 26BXC-4 using a tip-ring-sleeve cord equipped with a 310-type connector on the TTS 26BXC-4 end. TO TTS 26 SEND jack J5 on the TTS 26BXC-4 is patched to the LOOP SIGNALING SEND 1 or 2 jack on the TTS 26B using a tip-ring cord equipped with a 310-type connector on each end.

4.5 Incoming signals from the circuit under test that make use of the ''A'' relay on the TTS 26BXC-4 are usually received in B LP IN jack J3 on a tip-ring cord. The measuring circuit connections are then established by REC CKT switch S2 and ''A'' RELAY switch S3. When a composite signaling circuit relay is to be measured, it is patched to R LP SX RLY jack J2 and the incoming signal is received on its sleeve. For this condition,TO TTS 26 REC jack J6 is patched to the REC LOOP jack of the TTS 26B using a tip-ring 310-type connector. In the latter case, REC CKT switch S2 and ''A'' RELAY switch S3 are not in the circuit.

SECTION 5

MAINTENANCE AND CALIBRATION

5.1 INTRODUCTION.

5.2 The Model TTS 26BXC-4 does not require any preventative maintenance. The only calibration necessary is a periodic adjustment of the "A" relay.

5.3 SERVICE INFORMATION.

5.4 Each instrument manufactured by Northeast Electronics is warranted for a period of one year upon delivery to the original purchaser. Complete warrenty information is located on the rear of the title page of this manual. Note that written authorization is required prior to the return of any equipment for factory repairs. Additional service information can be obtained by contacting Northeast Electronics, Customer Service Department, P.O. Box 649, Concord, New Hampshire, 03301, telephone 603-224-6521.

5.5 "A" RELAY CALIBRATION.

5.6 The internal "A" relay should be checked periodically to insure its proper adjustment. Refer to Table 5–1 for the proper curent criteria used for calibration. Refer to Table 5–2 for the proper pulsing criteria used for calibration.

5.7 The following criteria are not absolute limits but the majority of iron core "A" relays should operate within these limits.

Table 5–1. Current Criteria.

State	Test	Adjust
Non-Operate	14.2 mA	14.4 mA
Operate	15.0 mA	14.8 mA

Table 5–2. Pulsing Criteria.

Pulse	Conditions	Results
60% at 12 pps	LKA – 0 ohm Loop res	40 to 50% Brk
68% at 12 pps	Norm LK – 1400 ohm Loop res	80 to 87% Brk
60% at 12 pps	LKA – 1200 ohm Loop res	55 to 65% Brk

SECTION 6

ELECTRONIC PARTS LIST

6.1 **INTRODUCTION.**

6.2 This section provides the parts list and associated component location drawings for easy location and identification of parts. Table 6—1 provides a list of FSCM (Federal Supply Code of Manufacturers) code numbers and corresponding manufacturers. Tables 6—2 through 6—5 are the parts lists and Figure 6—1 is the component location diagram for the Model TTS 26BXC-4 Circuit board E95074.

Table 6—1. List of Manufacturers.

Code No.	Manufacturer
04221	Midtex Inc., Mankato, Minn. 56001
04773	Automatic Electric, Northlake, Ill. 60164
12697	Clarosat Mfg., Co., Dover, N.H. 03820
13606	Sprague Electric Co., Concord, N.H. 03301
27735	F-DYNE Electronics, Bridgeport, Conn. 06600
71590	Centralab Electronics, Milwaukee, Wis. 53201
78957	Stromberg-Carlson Corp., Charlottsville, Va. 22902
80368	Sylvania Electric Inc., NewYork, N.Y. 10017
82389	Switchcraft Inc., Chicago, Ill. 60630
94322	Tel-labs Inc., Manchester, N.H. 03102

Table 6—2. Model TTS 26BXC-4 Overall Assembly Parts List.

REFERENCE DESIGNATOR	DESCRIPTION			MFGR.	MFGR. PART NO.	N.E.C. PART NO.
J1	SPECIAL			82389	5J-1329	650401300
J2	SAME AS J1					
J3	SAME AS J1					
J4	SAME AS J1					
J5	SPECIAL			82389	5J-1192	650401000
J6	SAME AS J1					
J7	SAME AS J1					
K1			48V	04773	PR-1610-A4	600300100
PC1	E-95074 PC BD					A002652004
PL1		50MA	48V	80368	60A	730000200
PL2	SAME AS PL1					
R1	750-	3W 1%		94322	EL2B	210307511
R2	1K	3W 1%		94322	EL2B	210310011
R3	SAME AS R1					
R4	SAME AS R2					
R45	800-800	2W		12697	CM33022NP	238008010
R45B	SAME AS R45					
S1	2C-2C	CONTACT		78957	173N	630100600
S2	4C-4C	CONTACT		78957	173P	630100700
S3	SAME AS S2					
S4	S-4					A002652007
S5	SAME AS S4					
S6	S-6					A002652003
S7		3A,300W	125V	82389	29203L	630400100
S8	DIAL,TEL.			04773	D-84821-C	836000100

Table 6—3. Model TTS 26BXC-4 Switch S6 Assembly Parts List.

REFERENCE DESIGNATOR	DESCRIPTION			MFGR.	MFGR. PART NO.	N.E.C. PART NO.
R25	600#	3W 1%		94322	EL2B	210360001
R26	1.4K	3W 1%		94322	EL2B	210314011
R27	2.2K	3W 1%		94322	EL2B	210322011
R28	SAME AS R25					
R29	SAME AS R26					
R30	SAME AS R27					
S6		2.75A	15V	71590	PA-1013	625102200

Table 6—4. Model TTS 26BXC-4 Circuit Board E95704 Parts List.

REFERENCE DESIGNATOR	DESCRIPTION			MFGR.	MFGR. PART NO.	N.E.C. PART NO.
C1	.15UF		10% 100V	13606	225P15491XD3	320001540
C2	SAME AS C1					
C3	4UF		200V	27735	D-4.0-200-10	301304050
C4	SAME AS C3					
C5	SAME AS C3					
C6	2UF		200V	27735	D-2.0-200-10	301302050
C7	.5UF		1% 100V	27735	MPC12-.5-100-1	321805040
K2	2.6K		48V	04221	156-14D100	604100100
R5	100#	10W	1%	94322	EL10A	210610001
R6	200#	5W	1%	94322	EL5	210420001
R15	SAME AS R5					
R16	SAME AS R6					
R35	600#	3W	1%	94322	EL2B	210360001
R37	SAME AS R35					
R38	1K	3W	1%	94322	EL2B	210310011
R39	500#	3W	1%	94322	EL2B	210350001
R40	570#	3W	1%	94322	EL2B	210357001
R41	SAME AS R38					
R42	2K	3W	1%	94322	EL2B	210320011
R43	SAME AS R42					
R44	1.2K	3W	1%	94322	EL2B	210312011

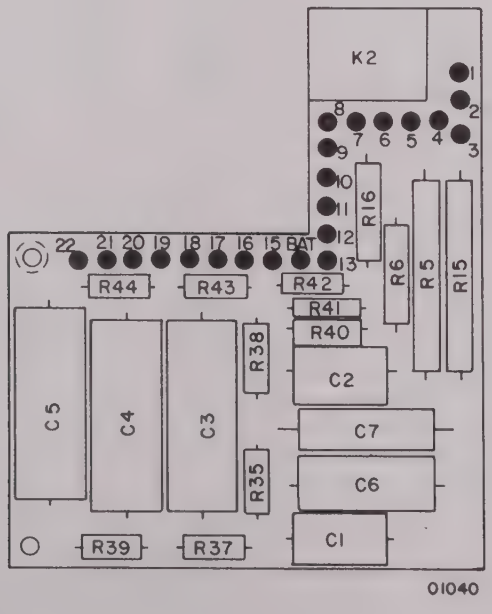


Figure 6—1. TTS 26BXC-4 Circuit Board 95704, Component Location.

Table 6—5. Model TTS 26BXC-4 Switch S4 Assembly Parts List.

REFERENCE DESIGNATOR	DESCRIPTION			MFGR.	MFGR. PART NO.	N.E.C. PART NO.
R31	450#	3W 1%		94322	EL2B	210345001
R32	SAME AS R31					
R33	10.25K	3W 1%		94322	EL2B	210310221
R34	10K	3W 1%		94322	EL2B	210310021
R36	4.45K	3W 1%		94322	EL2B	210344511
R46	2K	3W 5%		13606	TYPE 3X	210302025
R47	15K	1/2W 1%		19701	MF7C	220601531
S4		1A	28V	76854	280180-F9	625802100

Table 6—6. Model TTS 26BXC-4 Switch S5 Assembly Parts List.

REFERENCE DESIGNATOR	DESCRIPTION			MFGR.	MFGR. PART NO.	N.E.C. PART NO.
R7	300#	3W 1%		94322	EL2B	210330001
R8	400#	3W 1%		94322	EL2B	210340001
R9	500#	3W 1%		94322	EL2B	210350001
R10	600#	3W 1%		94322	EL2B	210360001
R11	700#	3W 1%		94322	EL2B	210370001
R12	800#	3W 1%		94322	EL2B	210380001
R13	900#	3W 1%		94322	EL2B	210390001
R14	1K	3W 1%		94322	EL2B	210310011
R17	SAME AS R7					
R18	SAME AS R8					
R19	SAME AS R9					
R20	SAME AS R10					
R21	SAME AS R11					
R22	SAME AS R12					
R23	SAME AS R13					
R24	SAME AS R14					
S5		2.75A	15V	71590	PA-1015	625100300

SECTION 7

SCHEMATIC DIAGRAM

7.1 INTRODUCTION.

7.2 This section provides the schematic diagram, Figure 7 – 1, for the Model TTS 26BXC-4 Circuit Panel Accessory.

NOTE:
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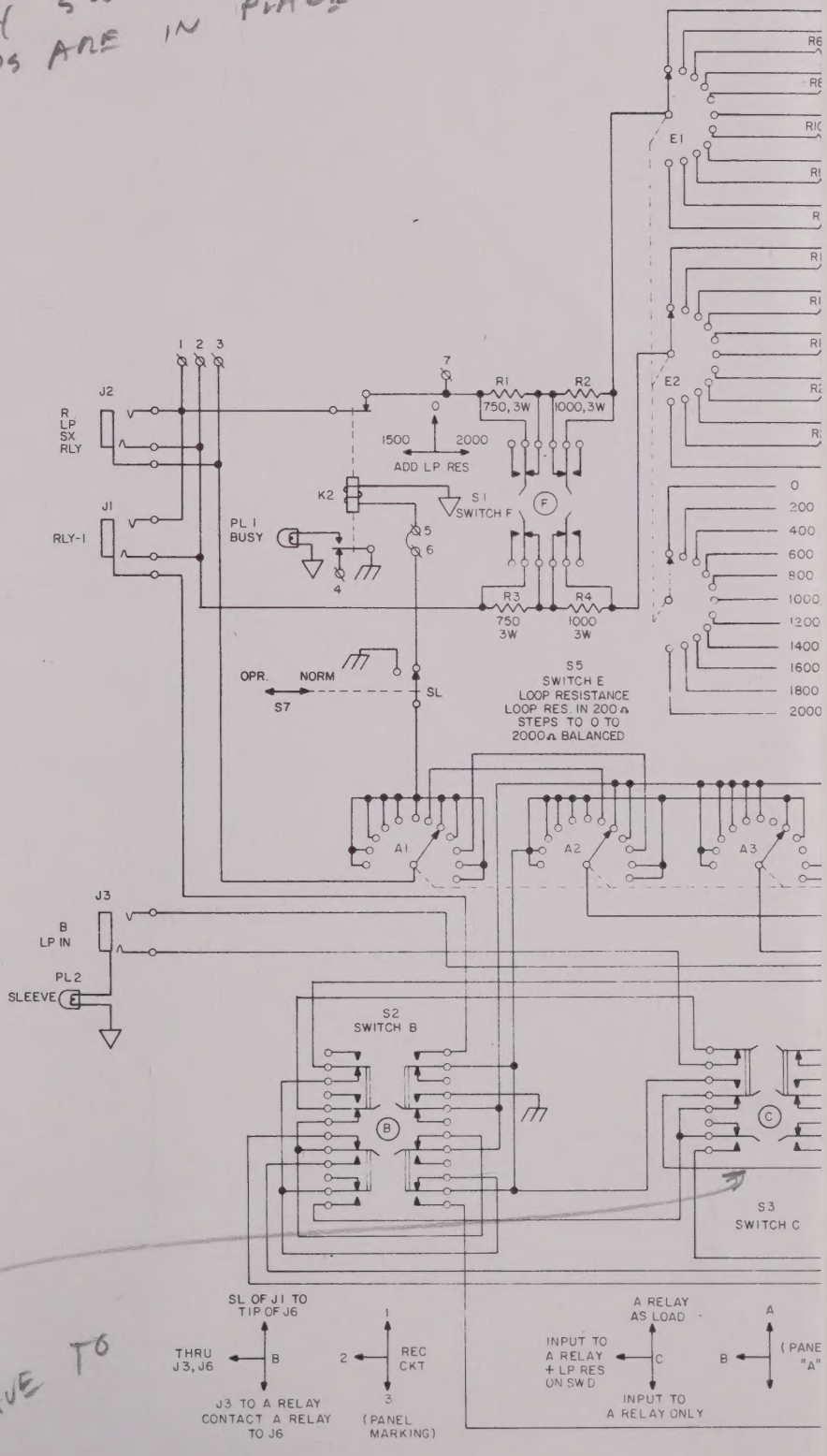
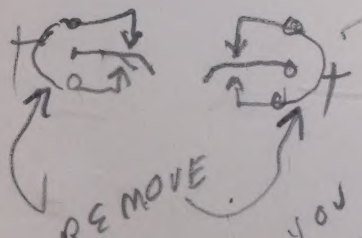




REMOVE

(IF YOU HAVE TO REMOVE SWAP ORG +B+W WIRES ON A RY

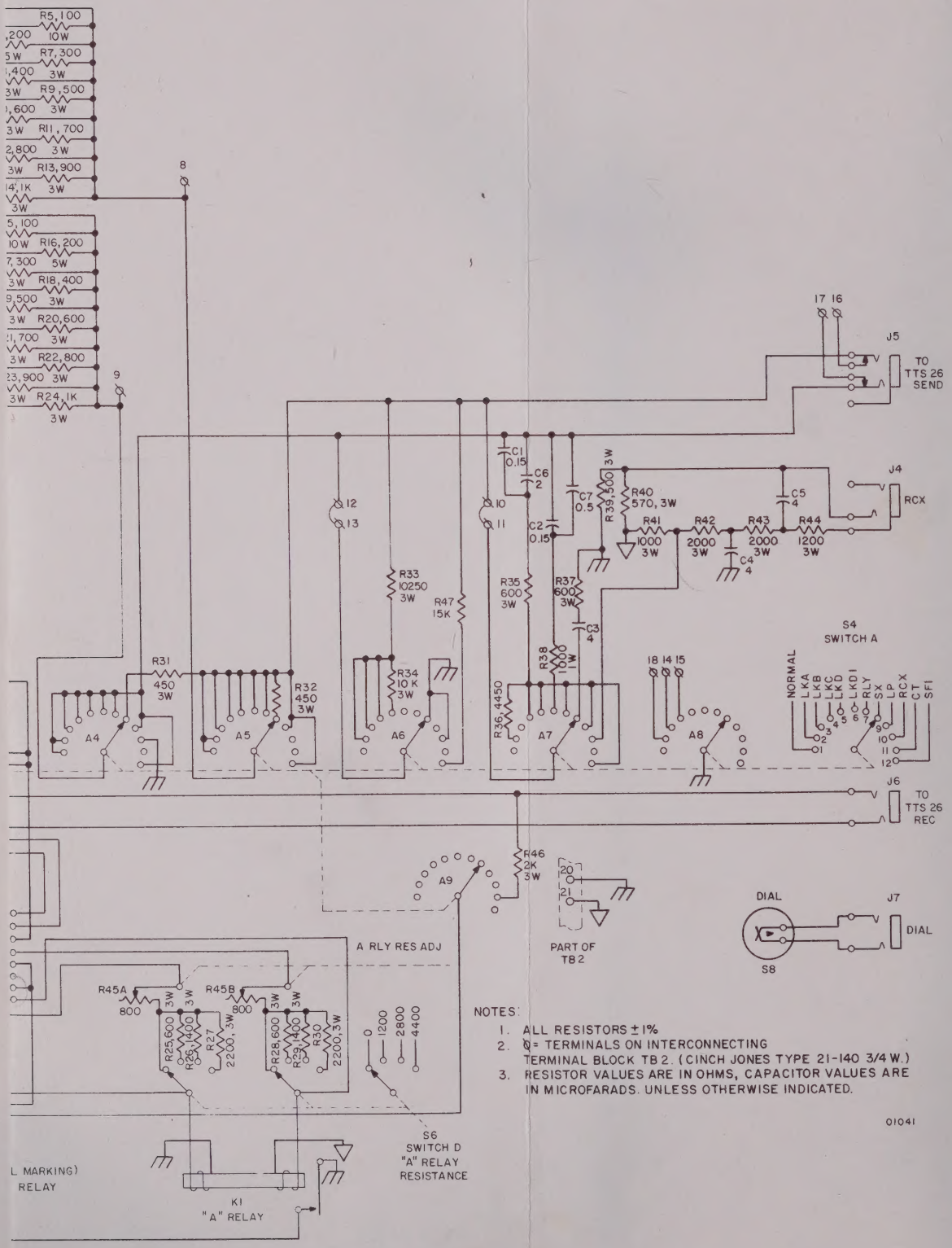
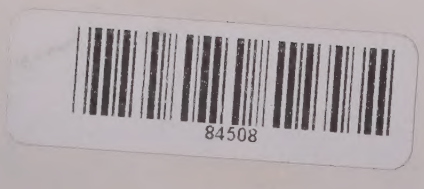


Figure 7—1. TTS 26BXC-4 Overall Schematic Diagram.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